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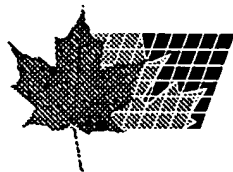
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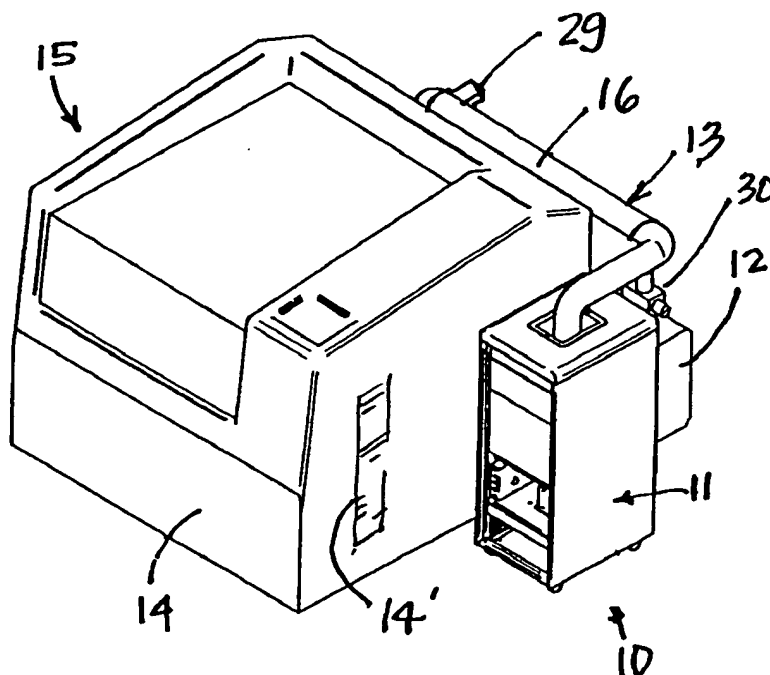
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(54) SYSTEME DE PURIFICATION D'AIR POUR DISPOSITIFS

FONCTIONNANT DANS UN MILIEU SANS POUSSIÈRE ET
SANS PRODUIT CHIMIQUE EN SUSPENSION DANS L'AIR

(54) PURIFICATION AIR SYSTEM FOR DEVICES OPERATING IN
DUST AND AIRBORNE CHEMICALS-FREE ENVIRONMENT



(57) An integrated air purifier for use in combination with one or more device(s) mounted in one or more enclosure(s) and requiring a purified substantially dust and/or airborne chemicals-free immediate environment. The air purifier is provided with air and/or carbon filters to purifier ambient air drawn from an air inlet port by a fan and fed to an air exhaust port. A conduit interconnects the air exhaust port of the air purifier to an air inlet port of the enclosure. The fan injects purified air under pressure in the enclosure to create a positive pressure air flow with air exhausting through existing openings provide in the enclosure whereby to prevent the infiltration of unwanted ambient air in the enclosure. A sterile steam humidifier may also be connected between the air exhaust port of the air purifier and the air inlet port of the enclosure to inject a regulated amount of humidity in the purified air.

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**PURIFICATION AIR SYSTEM FOR DEVICES
OPERATING IN DUST AND AIRBORNE CHEMICALS-FREE ENVIRONMENT**

ABSTRACT

An integrated air purifier for use in combination with one or more device(s) mounted in one or more enclosure(s) and requiring a purified substantially dust and/or airborne chemicals-free immediate environment. The air purifier is provided with air and/or carbon filters to purifier ambient air drawn from an air inlet port by a fan and fed to an air exhaust port. A conduit interconnects the air exhaust port of the air purifier to an air inlet port of the enclosure. The fan injects purified air under pressure in the enclosure to create a positive pressure air flow with air exhausting through existing openings provide in the enclosure whereby to prevent the infiltration of unwanted ambient air in the enclosure. A sterile steam humidifier may also be connected between the air exhaust port of the air purifier and the air inlet port of the enclosure to inject a regulated amount of humidity in the purified air.

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**PURIFICATION AIR SYSTEM FOR DEVICES
OPERATING IN DUST AND AIRBORNE CHEMICALS-FREE ENVIRONMENT**

5 FIELD OF THE INVENTION

 The present invention relates to an integrated air purifier for use in combination with one or more devices that is(are) mounted in one or more enclosure(s) which enclosed devices operate more efficiently when the immediate
10 air has very low levels of dust, airborne chemicals and/or controlled levels of humidity. A sterile steam humidifier is integratable with the air purifier for "low humidity" environments that require the immediate environment to have steady levels of higher humidity.

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BACKGROUND OF THE INVENTION

 Many devices in the various industries, the electronics and/or printing industry, for example, require a substantially dust and/or airborne chemicals free immediate
20 environment to ensure its proper operation, longevity, reduce operating/maintenance costs, and/or to enhance the performance of the device(s). Such devices are usually housed in an enclosure with the enclosure being custom fitted with air treating devices and often requiring
25 controlled air humidification. Accordingly, it is necessary to modify these enclosures to accept these air treating devices. Without treated air it is often necessary to shut down the enclosed devices in order to conduct maintenance to the various equipment fitted therein, and/or to accept
30 reduced performance and possibly higher repair/life cycle costs. The lack of treated air is a costly proposition. Other devices require that they be placed in a substantially dust-free and/or humidity controlled room to ensure their proper operation, and/or to have airborne chemical
35 contaminants removed. This is a further expensive proposition without integrated air treating equipment, as many rooms are large, and difficult to control. The cost to

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create "Cleanroom Type" environments in these rooms can be expensive. Many enclosed devices operate in low-humidity environments which negatively affects performance. Higher levels of humidity must be achieved and maintained to ensure the enclosed devices operate more efficiently. Achieving and maintaining the desired humidity levels inside the immediate environment of the enclosed device is difficult to achieve and maintain if attempted by controlling the room humidity levels, and it can be costly. Many enclosed devices operate with equipment that generates heat intermittently which reduces humidity levels inside the enclosed device.

SUMMARY OF THE INVENTION

It is a feature of the present invention to provide an integrated air purifier which is used in combination with one or more device(s) mounted in one or more enclosure(s) and requiring a purified, substantially free of dust and/or chemicals, in the immediate environment and wherein the purifier is a standalone unit integrated with the enclosed device(s).

Another feature of the present invention is to provide an integrated air purifier having a sterile steam humidifier which is connected between the air purifier and the enclosure of the device whereby to inject a regulated amount of humidity in the purified air and avoid condensation inside the enclosed device.

Another feature of the present invention is to provide an integrated air purifier and humidifier system which is easy to service and which is auto-regulated.

A still further feature of the present invention is to provide an integrated air purifier and humidifier system which substantially overcomes the above-mentioned disadvantages of the prior art.

According to the above features, from a broad aspect, the present invention provides an integrated air purifier for use in combination with one or more device(s)

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mounted in one or more enclosure(s) and requiring a purified, substantially free of dust and/or airborne chemicals, in the immediate environment. The air purifier has filter means therein to purify ambient air drawn from an air inlet port of the purifier by blower means and fed to an air exhaust port thereof. A conduit interconnects the air exhaust port of the air purifier to an air inlet port of the enclosure. The blower means injects purified air under pressure in the enclosure to create a positive pressure air flow with air exhausting through existing openings provided in the enclosure whereby to prevent the infiltration of unwanted ambient air in the enclosure.

According to a still further broad aspect of the present invention a sterile steam humidifier is used in combination with the air purifier whereby a regulated amount of humidity is injected in the purified air which is supplied to the air inlet port of the enclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiments of the present invention will now be described with reference to the accompanying drawings in which

FIG. 1 is a perspective view showing an integrated air purifier constructed in accordance with the present invention and having a sterile steam humidifier in combination therewith and connected to the enclosure of a pre-press printing device as utilized in the printing industry;

FIG. 2 is a perspective view of the integrated air purifier, and ;

FIG. 3 is a schematic illustration of the basic component parts of the sterile steam humidifier utilized with the integrated air purifier.

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DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings and more particularly to Figure 1 there is shown generally at 10 the air purification system and comprised by an integrated air purifier 11. The air purifier 11 is herein equipped with a sterile steam humidifier 12 for supplying purified air with controlled humidity, through a conduit 13, to the enclosure 14 of a printing device 15 as utilized in the printing industry. The sterile steam humidifier 12 is connected to the conduit 13 and more specifically to a mixing chamber portion 16 thereof constituted by a pipe section which is at least 4 feet to 5 feet long and having a 6 inch diameter pipe (pipe is smaller for non humidity applications) whereby to ensure that the steam produced by the humidifier is completely absorbed in the purified air prior to being injected in the enclosure 14.

Referring now additionally to Figure 2 it can be seen that the air purifier 11 consists of a housing 17 and provided with a door 18 to provide access to the air and/or carbon filter banks 19 mounted in the top portion of the housing. A blower or fan 20 is mounted above an air inlet port 21 and has sufficient capacity to draw ambient air from the bottom of the housing 17 and push it through the filter banks 19 and out through an air exhaust port 22. The conduit 13 is connected in substantially sealing relationship with the exhaust port 22. The air filters 19 are of types well known in the art and capable of purifying air. The fan is also of sufficient capacity to create a positive air flow into the printing equipment enclosure 14 with air exiting out of the enclosure through existing openings such as holes, cracks or vent openings 14', so that the enclosure has an internal positive pressure to prevent the infiltration of unwanted ambient air. The fan has a capacity and can have a variable speed to effectuate approximately from about 25 to about 100 air exchanges in an enclosure per hour. On the other hand, different fans can be used to suit an associated enclosure.

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As also shown in Figure 2 the air and/or carbon filters are slidably received in filter brackets 23 and in substantially sealing relationship with the top walls 24 of the housing 17 whereby all of the air entering the air inlet 5 21 is filtered through the filter bank. The door frame is also provided with a seal 25 thereabout to complete the seal about the filters. The air exiting the air exhaust port 22 is substantially purified to produce a "Class 10,000" cleanroom environment. Detector 26 are mounted in close 10 proximity to the exhaust 22 to sense the condition of the filters and an indicator panel 27 is provided with indicator lamps 28 to alert a user that one or more of the filters 19 require a change.

Referring now to Figures 1 and 3 there will be 15 briefly described the humidity producing system utilized with the air purifier 11 and it consists of a technically advanced, steam humidifier that produces mineral free, odorless, sterile steam. Such humidifiers are known in the art. A humidity sensor 29 is secured at the end of the 20 external mixing chamber portion 16 or if necessary elsewhere inside the enclosure 14 of the conduit 13, just prior to the air entering into the enclosure 14, to provide live feedback to a three-way electronic control valve 30 or directly to the humidifier 12 to precisely regulate the output humidity 25 level. The sensor could also be mounted in the enclosure depending on the size of the enclosure. As shown in this configuration in Figure 2 the control valve 30 is connected to an outlet pipe 31 of the sterile steam humidifier 12. In this configuration excess humidity is vented to the room 30 environment through a vent 32 connected to the control valve 30. Alternately a humidifier may receive the data from the humidity sensor and adjust the output humidity level without exhausting any humidity into the room environment.

The humidifier 12 automatically enters into a 35 "sleep" mode if room humidity reaches a predetermined upper level. The mixing chamber portion 16 of the conduit 13 is sized to allow the steam to be fully absorbed by the air

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prior to entering the enclosure 14 and to eliminate the possibility of condensate forming inside the printing equipment enclosure. The humidifier is auto-regulated and has a humidity control circuit 33 which receives control signals from the sensor 39 which is sensing ambient air. An electrode air purifier 34, herein also schematically illustrated, removes impurity from the humid air and a sludge removal system 35 is mounted in the base of the humidifier and provided with a disposable cylinder 37 for low maintenance sludge removal.

It is pointed out that electrode steam humidifiers, currently available on the market, produce pure uncontaminated moisture to protect sensitive equipment. Some of these systems utilize auto-adaptive controls to automatically adjust to water supply conditions. There are no heating elements in such humidifiers and accordingly they do not get coated with mineral deposits and sludge. Any water borne impurities are removed at the electrodes and deposited in a cylinder where they are periodically flushed out through a drain such as the drain 36 illustrated in Figure 3. Solid mineral scale sinks to the bottom of the cylinder which, when filled with residue is easily discarded and replaced. These humidifiers are also provided with cylinder status indicators 38, either audible or visual, to advise the user when cylinder replacement is required.

Although the air purifier system of the present invention is herein illustrated as adapted to a pre-press printing equipment as utilized in the printing industry, there are numerous other adaptations, such as electronic equipment, computer equipment, medical equipment etc. However, we have found that in the printing industry such air purifiers are necessary as a minimum for proofers, imagesetters, or computer-to-plate devices having optic and electronic circuitry, etc. It is therefore within the ambit of the present invention not to restrict the application of the integrated air purifier as described herein, sufficient only to say, that it is used in combination with a device

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mounted in an enclosure and requiring a purified, substantially dust and/or airborne chemicals-free, immediate environment, with an option for controlled humidity for rooms or sites that have low humidity.

CLAIMS:

1. An integrated air purifier for use in combination with one or more device(s) mounted in one or more enclosure(s) and requiring a purified, substantially dust and/or airborne chemicals-free immediate environment, said air purifier having filter means therein to purify ambient air drawn from an air inlet port by blower means and fed to an air exhaust port, a conduit for interconnecting said air exhaust port of said air purifier to an air inlet port of said enclosure, said blower means injecting purified air under pressure in said enclosure to create a positive pressure air flow with air exhausting through existing openings provided in said enclosure whereby to prevent the infiltration of unwanted ambient air in said enclosure.
 2. An integrated air purifier as claimed in claim 1 wherein there is further provided a steam humidifier connected between said air exhaust port of said air purifier and said air inlet port of said enclosure to inject a regulated amount of humidity in said purified air.
 3. An integrated air purifier as claimed in claim 2 wherein said steam humidifier is a sterile steam humidifier and an electrode isothermal steam humidifier for producing mineral free, odorless, sterile steam, said humidifier having an outlet connection connected to said conduit, a control valve connected to said outlet pipe, a humidity sensor to detect the volume of humidity in said air flow entering said enclosure and providing signals to said control valve to regulate the humidity level at said outlet connection, and a vent connected to said control valve to release excess humidity into ambient air.
 4. An integrated air purifier as claimed in claim 2 wherein at least part of said conduit constitutes a mixing chamber, said humidity sensor being connected at an outlet
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of said mixing chamber in close proximity to said air inlet port of said enclosure.

5. An integrated air purifier as claimed in claim 2 wherein said blower means is a fan having a capacity sufficient to effectuate approximately from about 25 to 100 air exchanges per hour in said enclosure.

6. An integrated air purifier as claimed in claim 2 wherein said filter means is constituted by a bank of air and/or carbon filters disposed in substantially sealing relationship with an air flow passage within said air purifier to produce purified air capable of creating a "Class 10,000" cleanroom type environment inside said enclosure.

7. An integrated air purifier as claimed in claim 6 wherein said air purifier is also provided with filter monitoring means to sense the condition of said filters, and indicator means to alert a user that a filter change is required.

8. An integrated air purifier as claimed in claim 4 wherein said mixing chamber has a predetermined volume sufficient to allow said steam to be absorbed in said purified air prior to being injected in said enclosure.

9. An integrated air purifier as claimed in claim 8 wherein said humidifier is auto-regulated by a humidity control circuit and provided with an electrode air purifier and a sludge removal system whereby to produce uncontaminated moisture.

10. An integrated air purifier as claimed in claim 1 wherein said device mounted in said enclosure is one of a proofer, an imagesetter, or a computer-to-plate device

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having optics and electronics, as utilized in the printing industry.

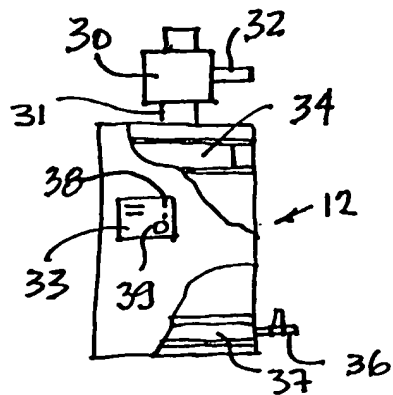


FIG. 3

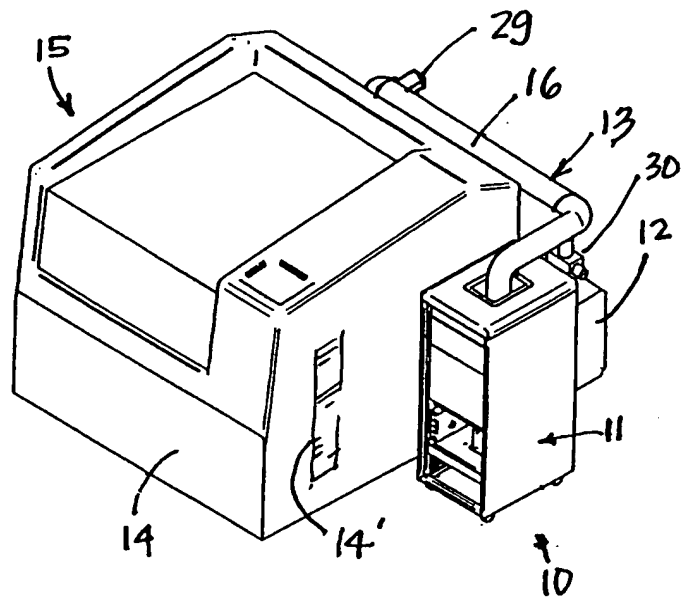


FIG. 1

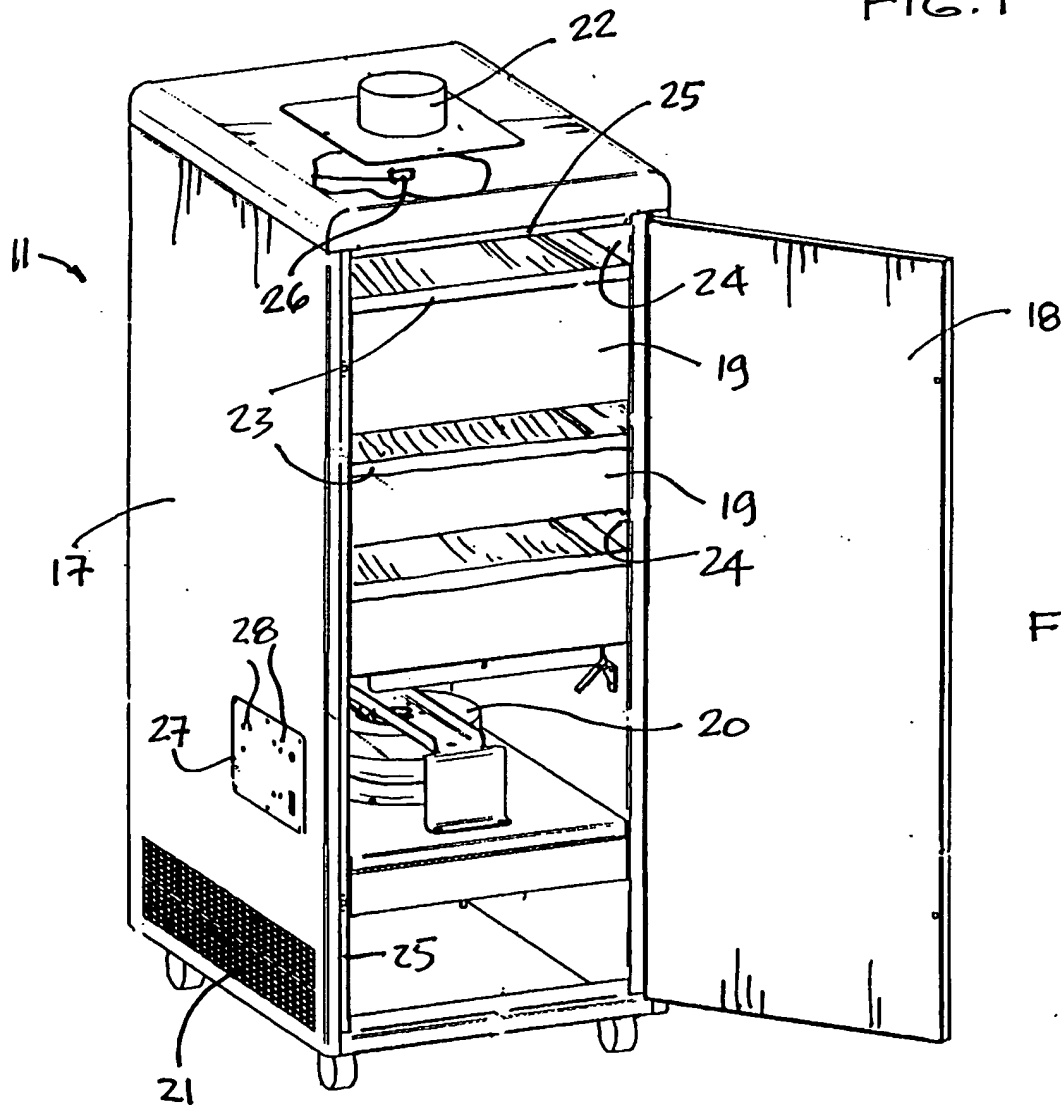


FIG. 2

